

## Functions

The Scan Tool provides a number of built in functions. These functions may be used in the calculated PIDs' expressions.

### time()

Syntax: time(frame)  
 Arguments: frame (optional): the frame number.  
 Return value: The specified frame's time, in milliseconds since the first frame was logged.  
 If the frame number is not specified the current frame number is used.

### frame()

Syntax: frame()  
 Arguments: None.  
 Return value: The current frame number.

### value()

Syntax: value({PID},frame)  
 Arguments: {PID}: a PID name.  
 frame (optional): an expression.  
 Return value: The specified PID's value for the specified frame.  
 If the frame number is not specified the current frame number is used.  
 If the frame number is less than 0 then frame 0 is used.  
 If the frame number is greater than the last frame, then the last frame is used.

### raw()

Syntax: raw({PID},frame)  
 Arguments: {PID}: a PID name.  
 frame (optional): an expression.  
 Return value: The specified PID's raw value for the specified frame.  
 If the frame number is not specified the current frame number is used.

### iff()

Syntax: iff(condition,true\_value,false\_value)  
 Arguments: condition: an expression.  
 true\_value: an expression.  
 false\_value: an expression.  
 Return value: true\_value if condition evaluates to not zero  
 false\_value if condition evaluates to zero

### dx()

Syntax: dx(PID,frame\_count)  
 Arguments: {PID}: a PID name.  
 frame\_count (optional): an expression.  
 Return value: The rate of change of the value of {PID} from the current frame-frame\_count to the current frame.

### damp()

Syntax: damp({PID},frame\_count)  
 Arguments: {PID}: a PID name.  
 frame\_count (optional): an expression.  
 Return value: The average value of {PID} from the current frame-frame\_count to the current frame.

**exp()**

Syntax: exp(x)  
 Arguments: x: a numeric expression.  
 Return value: e raised to the power x.

**log()**

Syntax: log(x)  
 Arguments: x: a numeric expression.  
 Return value: returns the natural logarithm of x.

**log10()**

Syntax: log10(x)  
 Arguments: x: a numeric expression.  
 Return value: the base 10 logarithm of x.

**pow()**

Syntax: pow(x,y)  
 Arguments: x: a numeric expression.  
 y: a numeric expression.  
 Return value: x raised to the power y.

**sqrt()**

Syntax: sqrt(x)  
 Arguments: x: a numeric expression.  
 Return value: the square root of x.

**lookup()**

Syntax: lookup(x,a1,a2,b1,b2,...,c1,c2)  
 Arguments: x: a numeric expression  
 a1,a2,b1,b2,...c1,c2 is a list of pairs of values.  
 Return value: The value of the second value of the pair whose first value is less than or equal to x.  
 The list of value pairs **must** be sorted on the first value of each pair.

**gvmkg()**

Syntax: gvmkg ()  
 Arguments: None.  
 Return value: The gross vehicle mass in kilograms, which is specified in the vehicle/customer data window.

**gvmlb()**

Syntax: gvmlb ()  
 Arguments: None.  
 Return value: The gross vehicle mass in pounds, which is specified in the vehicle/customer data window.

**displacement()**

Syntax: displacement ()  
 Arguments: None.  
 Return value: The engine's cylinder displacement in liters, which is specified in the vehicle/customer data window.